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SCIENTIFIC INVESTIGATIONS

A Comparison of Uvulopalatopharyngoplasty and Modified Radiofrequency Tissue Ablation in Mild to Moderate Obstructive Sleep Apnea: A Randomized Clinical Trial

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Study Objectives: To compare the efficacy of modified radiofrequency tissue ablation (MRFTA) with uvulopalatopharyngoplasty (UPPP) based on both subjective and objective outcome measures in patients with mild to moderate obstructive sleep apnea (OSA).

Methods: Forty patients with mild to moderate OSA were randomly divided into UPPP and MRFTA groups. Evaluation was made based on the apnea-hypopnea index (AHI), Sleep Apnea Quality of Life Index (SAQLI) and Epworth Sleepiness Scale (ESS), immediately before the surgery and 6 months postoperatively.

Results: The postoperative AHI scores were improved significantly in both groups, although the postoperative AHI in the UPPP group was significantly lower than in the MRFTA group (P = .02). The difference between success rates for moderate OSA in UPPP and MRFTA was significant (77% versus 30%, P = .03) but there was no significant difference between success rates for mild OSA in UPPP and MRFTA groups (70% versus 50%, P = .36). Comparing postoperative ESS scores in the 2 groups showed no significant difference (P = .24). The postoperative scores in social interaction, treatment-related symptoms domain, and SAQLI total score were significantly higher in the MRFTA group.

Conclusions: MRFTA as well as UPPP can greatly improve daytime sleepiness and AHI, especially in patients with mild OSA. MRFTA proved to be more effective than UPPP to enhance quality of life of patients with OSA. Further studies with longer follow-up are required to evaluate long-term safety and efficacy of these procedures.

Commentary: A commentary on this article appears in this issue on page 1023.

Clinical Trial Registration: Trial name: Comparison of RFTA (Radio-Frequency-Tissue-Ablation) and UPPP (Uvulopalatopharyngoplasty) in patients with mild to moderate obstructive sleep apnea. URL: http://en.search.irct.ir/view/18617. Registration number: IRCT2014060910160N3

Keywords: modified radiofrequency tissue ablation, obstructive sleep apnea, uvulopalatopharyngoplasty

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INTRODUCTION

Obstructive sleep apnea (OSA) is characterized by partial or complete upper airway obstruction during sleep. Four percent of men and 2% of women older than 50 years suffer from symptomatic OSA.[1–3] There is an indisputable association between OSA and hypertension, coronary heart disease, heart failure, arrhythmias, impaired vigilance, deficit in executive functioning, impaired fine motor coordination, and depression.[4–7] Considering the prevalence and physiological effects of untreated OSA, the importance of developing an effective management strategy for patients with OSA is unwavering.

Surgical treatments aim to relieve the obstruction by increasing the cross-sectional area of upper airway or to remove a specific obstructive lesion. OSA can occur at one or more levels of nasopharyngotracheal airway and it is important to identify the pattern of airway obstruction to develop an effective treatment. Drug-induced sleep endoscopy (DISE) is a safe technique that simulates natural sleep in a short time. Progressive doses of anesthesia are used in this technique to pharmacologically induce sleep, and then fiberoptic endoscopy is used to examine the upper airway and characterize the pattern of obstruction.[8]

Uvulopalatopharyngoplasty (UPPP) and radiofrequency tissue ablation (RFTA) are 2 frequently performed surgeries

BRIEF SUMMARY

Current Knowledge/Study Rationale: Radiofrequency tissue ablation precisely applies energy to reduce the volume of redundant tissue in the upper airway. Radiofrequency tissue ablation has been performed for years as a treatment for obstructive sleep apnea but the efficacy and long-term outcomes of this procedure have not been clearly established.

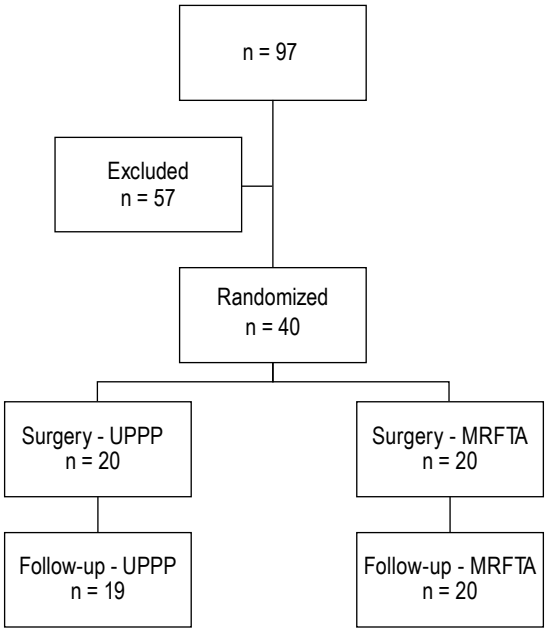
Study Impact: In this study, we performed the standard drug-induced sleep endoscopy technique to localize the specific site of airway obstruction. The aim of this study was to determine relative effectiveness of modified radiofrequency tissue ablation and uvulopalatopharyngoplasty based on subjective and objective outcomes measures in patients with mild to moderate obstructive sleep apnea.

for OSA. Fujita et al. first introduced UPPP in 1981.[9] UPPP increases the retropalatal airspace by removal or shortening of the uvula and soft palate and maybe resection of tonsils. UPPP offers great improvement in clinical symptoms, cardiovascular complications, recovery from motor vehicle accidents, and mortality rates in patients with OSA.[10–14]

RFTA precisely applies temperature-controlled energy to shrink the size of the uvula, soft palate, tonsils, and/or tongue, while sparing adjacent tissues.

Most studies recommended a particular surgery based on case series studies,[15,16] and no clear surgical approach has been developed for patients with OSA. Physiologic variables are broadly used as outcome measures in studies. The purpose of this randomized controlled trial was to compare the efficacy of UPPP with MRFTA based on both subjective and objective outcome measures in patients with mild to moderate OSA.

Figure 1—Study flow chart.



Ninety-seven patients were assessed for eligibility. Fifty-seven patients were excluded: 33 patients had an AHI ≥ 30, 12 patients had a BMI > 35, 6 patients had obstruction at the base of tongue, 2 patients had obstruction at the epiglottis, 1 patient had history of papillary thyroid carcinoma, and 3 patients declined to participate. Forty patients underwent randomization followed by surgery. One patient in UPPP was lost to follow-up because of migration to other state. MRFTA = modified radiofrequency tissue ablation, UPPP = uvulopalatopharyngoplasty.

METHODS

Study Population

This study was designed as a randomized unicenter trial to compare the efficacy of UPPP with MRFTA in patients with mild to moderate OSA. It was registered by the Iranian Registry of Clinical Trial (trial number: IRCT2014060910160N3). The research ethics committee of Tehran University of Medical Sciences fully approved the trial. Ninety-seven patients were assessed for eligibility criteria. Forty newly diagnosed adult patients from September 2014 to June 2015 with mild to moderate OSA, in whom their obstruction was characterized at the velopharyngeal or oropharyngeal lateral wall, were enrolled in the study (**Figure 1**).

Patients were extensively informed about the research project and surgical options with its expected effects and potential risks. Voluntary written informed consent was obtained from each participant. Patients were permitted to withdraw from the trial at any time, without any concern about their treatment. Inclusion and exclusion criteria are outlined in **Table 1**.

Clinical Evaluation

After a comprehensive history and physical examination, baseline clinical data were recorded, including age, sex, marital status, smoking status, systolic and diastolic blood pressure, body mass index, Friedman tongue position, and tonsil grade. Physical examination was supplemented with DISE. Patients received progressive doses of propofol administered by an anesthesiologist in the operating room. As patients began to snore, the first author passed a flexible fiberoptic endoscope through one side of the nose to evaluate the upper airway and identify the site of obstruction. According to VOTE classification, the most commonly involved structures are the velum, oropharyngeal lateral walls, tongue base, and

Table 1—Inclusion and exclusion criteria.

Inclusion	Exclusion
• Age > 18 years • Symptomatic OSA with 5 ≤ AHI < 30 • Velopharyngeal or oropharyngeal lateral walls obstruction • No prior treatment • BMI < 35 kg/m^2 • ASA class 1 or 2 or 3 • Provided informed consent	• Pediatric patients • AHI ≥ 30 • Tongue base or Epiglottis obstruction • Previous history of palatal surgery • Previous history of head and neck cancer or radiation • Dysmorphic face or craniofacial syndrome • Severe comorbidities • Major depression or unstable psychiatric disorders • BMI > 35 kg/m^2 • ASA class 4 or 5 • Unwillingness to participate in trial

AHI = apnea-hypopnea index, ASA = American Society of Anesthesiologists, BMI = body mass index, OSA = obstructive sleep apnea.

epiglottis (the "VOTE" acronym originates from the first letter of the four structures). For each structure, the degree of obstruction and its configuration should be determined. The degree of obstruction is classified as: 0 = no obstruction (no vibration, < 50%), 1 = partial obstruction (vibration 50% to 75%), 2 = complete obstruction (collapse, > 75%), x = not visualized. The configuration of obstruction can be described as anteroposterior, lateral, and concentric.[8] Patients with obstruction at the velum or oropharyngeal lateral wall were eligible for this study. The velum includes the soft palate, uvula, and lateral pharyngeal wall of the velopharynx. The oropharyngeal lateral wall includes the palatine tonsil and the lateral pharyngeal wall tissue.

Polysomnography

All patients underwent a full standard polysomnography (PSG). Page-by-page analysis and scoring of the electronic data were done in accordance with American Academy of Sleep Medicine (AASM) guidelines.[17] Apnea-hypopnea index (AHI), and lowest and mean oxygen saturation were reported. An apnea was defined as a decrease in airflow more than 90% from baseline for more than 10 seconds and hypopnea as a decrease in airflow more than 30% from baseline for more than 10 seconds with a ≥ 3% reduction in oxygen saturation or with arousal. AHI was obtained by dividing the sum of apneas and hypopneas by hours of sleep. Using the AHI, OSA is classified as mild (AHI = 5–14), moderate (AHI = 15–29), or severe (AHI ≥ 30).[18]

Questionnaires

All patients completed questionnaires including the Persian version of Sleep Apnea Quality of Life Index (SAQLI) and Epworth Sleepiness Scale (ESS).

The SAQLI is a widely used specific quality-of-life measure including 4 domains: (A) daily functioning, (B) social interaction, (C) emotional functioning and (D) symptoms. The treatment-related symptoms domain (E) is an additional domain to evaluate the effect of treatment.[19,20] Each of the domain scores and the SAQLI total score has a potential range from 1 to 7. Higher scores indicate better quality of life.

The ESS is an 8-item questionnaire that measures the probability of falling asleep in 8 specific situations.[21,22]

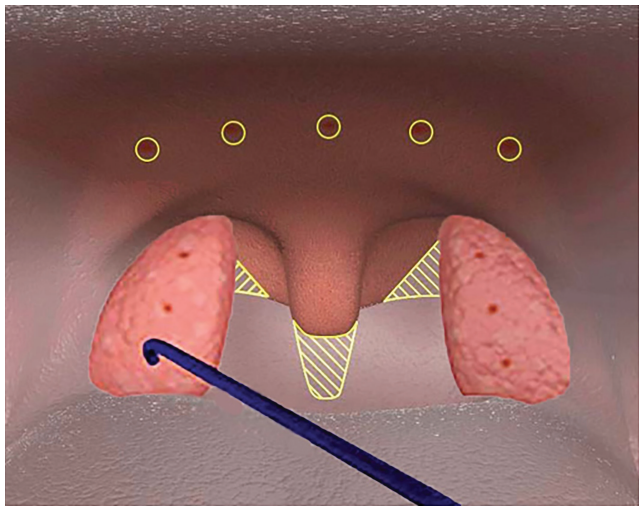
Randomization

Patients who were enrolled in the study were registered by contacting the trial coordinator. Randomization took place in the operating room by opening a sealed, numbered envelope. The envelopes were prepared by the trial statistician by using the block randomization method (block size of 4). Investigators and individuals who analyzed the outcomes were unaware of the randomization schedule.

Procedure

Both MRFTA and UPPP techniques were performed by the first author. The MRFTA was performed using an RF generator (Celon AG Medical Instruments, Olympus, Japan). The soft palate and tonsils were sprayed with 10% lidocaine as a topical anesthetic. Lidocaine solution 2% with adrenaline was injected at 5 points below the border between the hard and soft palate and at 5 points on each tonsil. The soft palate was punctured at 5 points at regular distances around the midline of the soft palate (**Figure 2**). The applicator was inserted into the musculature until the applicator's insulation tube touched the tissue. The resection of excess mucous membrane in the soft palate was performed in a triangular shape on both sides of the uvula and then the resection of the uvula tip was performed. The uvula musculature was left in place as far as possible. The applicator tip was inserted into the tonsil and 4 to 6 lesions were performed on each side. The coagulation zones were approximately 1 cm apart. The status of coagulation was monitored via acoustic signal.

Figure 2—Application of MRFTA applicator and resection scheme.



This Figure is reproduced from Olympus surgical technologies publication. MRFTA = modified radiofrequency tissue ablation.

UPPP was performed under general anesthesia. The areas to be surgically excised were injected with lidocaine solution 2% with adrenaline. Bilateral tonsillectomy was performed initially by cold dissection. The bleeders required electrocoagulation. Following tonsillectomy, a horizontal incision was made from the base of the uvula to the upper poles of the bilateral anterior tonsillar pillars. The uvular mucosa was divided along the uvular edge and 1-cm full-thickness uvular muscle was excised. The approximation of anterior and posterior tonsillar pillars was performed using multiple absorbable sutures. Next, the denuded uvula and soft palate were approximated.

Patients in both groups were monitored for 24 hours before discharge. Pain was controlled posttreatment with acetaminophen and diphenhydramine syrup. Antibiotics and steroids were not prescribed.

Follow-Up

All the patients were monitored postoperatively for adverse events including pain, bleeding, respiratory compromise and nasal regurgitation at 1 week, 2 weeks, 4 weeks, and 6 months. At the 6-month visit, the questionnaires previously outlined

Table 2—Patients characteristics at enrollment.

Characteristic	Total (n = 40)	UPPP (n = 20)	MRFTA (n = 20)	*P*
Age, years				.37
Mean (SD)	37.40 (10.07)	35.73 (10.52)	39.07 (9.67)	
Range	21–57	21–56	24–57	
Male sex, n (%)	33 (82.5)	16 (80)	17 (85)	> .99
Married, n (%)	32 (80)	15 (75)	17 (85)	.69
Smoker, n (%)	12 (30)	7 (35)	5 (25)	.73
Smoking, pack-year (SD)	3.6 (4.64)	3.4 (4.41)	4.0 (5.32)	.72
BMI, kg/m^2, mean (SD)	27.7 (4.30)	27.2 (4.56)	28.24 (4.09)	.43
Friedman tongue position, n (%)				.82
1	20 (50)	11 (55)	9 (45)	
2	13 (32.5)	6 (30)	7 (35)	
3	5 (12.5)	2 (10)	3 (15)	
4	2 (5)	1 (5)	1 (5)	
Tonsil grade, n (%)				.47
1	13 (32.5)	6 (30)	7 (35)	
2	21 (52.5)	12 (60)	9 (45)	
3	5 (12.5)	2 (10)	3 (15)	
4	1 (2.5)	0 (0)	1 (5)	
AHI, events/h, mean (SD)	19.8 (6.40)	20.15 (6.92)	19.42 (6.04)	.76
Low O_2 saturation	84.9 (3.51)	84.2 (3.96)	85.33 (2.79)	.37
Mean O_2 saturation	92.1 (2.52)	91.8 (2.61)	92.47 (2.41)	.46
SBP	128.3 (13.1)	125.67 (11.78)	131.03 (14.16)	.27
DBP	83 (9.85)	82 (8.82)	84 (10.88)	.58
SAQLI total, mean (SD)	4.21 (0.35)	4.19 (0.44)	4.22 (0.23)	.86
ESS, mean (SD)	12.73 (4.69)	12.07 (3.89)	13.4 (6.02)	.44

AHI = apnea-hypopnea index, BMI = body mass index, DBP = diastolic blood pressure, ESS = Epworth Sleepiness Scale, MRFTA = modified radiofrequency tissue ablation, SAQLI = Sleep Apnea Quality of Life Index, SBP = systolic blood pressure, SD = standard deviation, UPPP = uvulopalatopharyngoplasty.

were completed and the posttreatment PSG was performed. The patients were evaluated for complications or adverse events.

Statistical Analysis

With n = 20 per group, this trial would have an 80% chance of detecting 30% difference in the groups' mean AHI. This calculation was based on a two-sample *t* test with a two-sided alternative hypothesis that assumed equal group variances and a type 1 error level of 5%. All statistical analyses were performed using SPSS software version 15 (IBM Corp, Armonk, New York, United States). Distribution of continuous variables was analyzed using the Kolmogorov-Smirnov test for normality. Continuous variables were expressed as mean and standard deviation (SD). Means were compared using the *t*-test. Difference between preoperative and postoperative measurement was tested using the paired *t* test. Nominal variables were tested using the χ^2 test. A *P* value less than .05 was considered statistically significant. Treatment success was defined as ≥ 50% reduction in AHI from baseline.

RESULTS

Forty patients with mild to moderate OSA who fulfilled the inclusion criteria were enrolled in this study. The patients were randomized to undergo UPPP or MRFTA and were followed up at 6 months. One patient in the UPPP group was lost to follow-up.

The mean ± SD of the age of the patients (n = 40) was 37.4 ± 10.07 years. Thirty-three of 40 patients (82.5%) were male and 32 patients (80%) were married. Twenty-eight patients (70%) were never-smokers. The mean ± SD pack-years in the smoker group was 3.6 ± 4.6. Mean ± SD AHI was 19.8 ± 6.4 events/h. Mean ± SD scores of SAQLI and ESS were 4.21 ± 0.35 and 12.73 ± 4.69, respectively. No significant difference was found between the UPPP and MRFTA groups in terms of age, sex, marital status, smoking, body mass index, Friedman tongue position, tonsil grade, or blood pressure. Baseline values of PSG indices, ESS, and SAQLI scores showed no significant differences between the 2 groups. The patients' baseline characteristics are summarized in **Table 2**.

The distribution of site and configuration of obstruction according to VOTE classification are shown in **Table 3**. Almost all patients had partial or complete obstruction at the velum and oropharynx. Most of the patients had partial lateral oropharyneal obstruction (57.5%). Forty percent of patients had complete concentric velopharyngeal obstruction and 32.5% had partial concentric velopharyngeal obstruction.

All patients were evaluated 6 months after surgery. The preoperative and postoperative variables are given in **Table 4** and the comparison of postoperative variables is summarized in **Table 5**. The postoperative AHI scores were significantly

Table 3—Classification of DISE findings.

Structure		Anteroposterior		Lateral		Concentric	
		Partial	Complete	Partial	Complete	Partial	Complete
Velum	UPPP	15% (3)	10% (2)	0% (0)	5% (1)	30% (6)	40% (8)
	MRFTA	10% (2)	5% (1)	5% (1)	5% (1)	35% (7)	40% (8)
Oropharynx	UPPP			60% (12)	40% (8)		
	MRFTA			55% (11)	40% (8)		
Base of tongue	UPPP	0% (0)	0% (0)				
	MRFTA	0% (0)	0% (0)				
Epiglottis	UPPP	0% (0)	0% (0)	0% (0)	0% (0)		
	MRFTA	0% (0)	0% (0)	0% (0)	0% (0)		

Values presented as % (n). DISE = drug induced sleep endoscopy, MRFTA = modified radiofrequency tissue ablation, UPPP = uvulopalatopharyngoplasty.

Table 4—Pretreatment and posttreatment scores in UPPP and MRFTA groups.

	UPPP			MRFTA		
	Pretreatment	Posttreatment	*P*	Pretreatment	Posttreatment	*P*
AHI	20.15 (6.92)	10.03 (3.28)	< .01	19.42 (6.04)	13.39 (4.36)	< .01
Low O_2 saturation	84.20 (3.96)	88.47 (3.50)	< .01	85.33 (2.79)	87.00 (2.61)	< .01
Mean O_2 saturation	91.80 (2.61)	94.93 (2.07)	< .01	92.47 (2.41)	94.00 (2.17)	< .01
SAQLI A	4.71 (0.30)	5.26 (0.31)	< .01	4.89 (0.34)	5.15 (0.19)	< .01
SAQLI B	4.00 (0.54)	5.50 (0.69)	< .01	4.28 (0.23)	5.98 (0.10)	< .01
SAQLI C	4.63 (0.96)	5.81 (0.37)	< .01	4.31 (0.41)	6.00 (0.23)	< .01
SAQLI D	3.44 (0.36)	4.81 (0.46)	< .01	3.38 (0.54)	4.62 (0.37)	< .01
SAQLI total	4.19 (0.44)	4.95 (0.40)	< .01	4.22 (0.23)	5.18 (0.12)	< .01
ESS	12.07 (3.89)	6.87 (1.99)	< .01	13.4 (6.02)	7.67 (1.71)	< .01

Values are presented as mean (standard deviation). AHI = apnea-hypopnea index, ESS = Epworth Sleepiness Scale, MRFTA = modified radiofrequency tissue ablation, SAQLI = Sleep Apnea Quality of Life Index, UPPP = uvulopalatopharyngoplasty.

improved from baseline in both groups, although the postoperative AHI in the UPPP group was significantly lower than the MRFTA group (P = .02). Fourteen of 19 patients (73%) in the UPPP group and 8 of 20 patients (40%) in the MRFTA group met the predefined success criteria. The success rate in the UPPP group was significantly higher than in the MRFTA group (73% versus 40%, P = .03). Within-group analysis showed that the success rates for mild and moderate OSA in the UPPP group were 70% (7/10) and 77% (7/9), respectively, and in MRFTA group, 50% (5/10) for mild OSA and 30% (3/10) for moderate OSA. The difference between success rates for moderate OSA in UPPP and MRFTA was significant (77% versus 30%, P = .03) but there was no significant difference between success rates for mild OSA in the UPPP and MRFTA groups (70% versus 50%, P = .36). Both the ESS and SAQLI scores improved significantly following UPPP and MRFTA. Comparing postoperative ESS scores in the 2 groups showed no significant difference (P = .24).

Postoperative SAQLI scores in three domains including daily functioning, emotional functioning, and symptoms showed no significant difference between the 2 groups but the postoperative SAQLI total score and scores in 2 domains including social interaction and treatment-related symptoms were significantly higher in the MRFTA group.

Table 5—Posttreatment scores in UPPP and MRFTA groups.

	UPPP	MRFTA	*P*
AHI	10.03 (3.28)	13.39 (4.36)	.02
Low O_2 saturation	88.47 (3.50)	87.00 (2.61)	.20
Mean O_2 saturation	94.93 (2.07)	94.00 (2.17)	.25
SAQLI A	5.26 (0.31)	5.15 (0.19)	.26
SAQLI B	5.50 (0.69)	5.98 (0.10)	.01
SAQLI C	5.81 (0.37)	6.00 (0.23)	.10
SAQLI D	4.81 (0.46)	4.62 (0.37)	.24
SAQLI E	1.58 (0.51)	1.04 (0.30)	.00
SAQLI total	4.95 (0.40)	5.18 (0.12)	.04
ESS	6.87 (1.99)	7.67 (1.71)	.25

AHI = apnea-hypopnea index, ESS = Epworth Sleepiness Scale, MRFTA = modified radiofrequency tissue ablation, SAQLI = Sleep Apnea Quality of Life Index, UPPP = uvulopalatopharyngoplasty.

Adverse Events

No serious adverse event in the perioperative and postoperative period, including death, bleeding, respiratory compromise, or a need for tracheotomy, was noted. Results of treatment-related

symptoms domain of SAQLI showed that negative effects of treatment on patient's quality of life was higher in the UPPP group (−1.58 versus −1.04, $P < .001$). Patients in the UPPP group reported that throat pain when swallowing, soreness in the nose or throat, having fluid/food pass into the nose when swallowing, and voice change had greater negative effects on their life. In the MRFTA group, the most prevalent treatment-related symptoms were voice change, pain in the throat when swallowing, and soreness in the nose or throat.

DISCUSSION

OSA is a common and potentially serious sleep disorder that should be considered as a major health issue due to its detrimental effects not only on physical functions but also social and mental functions.

Systematic reviews of surgical treatments of OSA showed that current evidence is not sufficient to determine the relative effectiveness of surgical options.[23–27] A systematic review and meta-analysis of 15 papers describing outcomes following UPPP by Caples et al. reported an overall reduction of 33% (95 confidence interval: 23% to 42%) in AHI. The average AHI at baseline was 40.3 and postoperative AHI was 29.8.[26]

Cahali et al. compared UPPP versus lateral pharyngoplasty in a randomized trial. This study found that daytime sleepiness and AHI improved in both groups, while the magnitude of improvement was significant in lateral pharyngoplasty.[28] Lojander et al. compared UPPP versus conservative management. The study found statistically significant improvements in daytime sleepiness and snoring in the UPPP group.[29] UPPP versus oral appliance therapy was evaluated in a study performed by Wilhelmsson et al. There was a significant difference in AHI in favor of oral appliance therapy. No significant differences in quality of life (measured through MSE-P questionnaire) were reported between the 2 groups.[30]

A meta-analysis of 16 studies using RFTA for OSA by Farrar et al. found a 31% reduction in short-term and a 45% reduction in long-term respiratory disturbance index levels, and a 31% reduction in short-term ESS. Short-term results of the lowest O_2 saturations did not improve.[31]

Hofmann et al. conducted a prospective nonrandomized clinical trial to evaluate the efficiency of UPPP and RFTA. Snoring was improved in both groups. AHI and hypopnea index showed statistically significant improvement in the UPPP group compared with the RFTA group, but postoperative pain duration was shorter in the RFTA group.[32]

Because of the complex pattern of collapsibility and the nature of airway obstruction, no surgical procedure could be consistently effective in different subgroups of patients with OSA. Generally the aim of this study was to compare the efficacy of UPPP with MRFTA in patients who are not severely obese (body mass index < 35) with mild to moderate OSA ($5 \leq AHI < 30$) who have velopharyngeal or oropharyngeal lateral wall obstruction. In this study, where DISE was performed to determine the site and pattern of obstruction,[8,24] the mean AHI decreased significantly from 20.15 ± 6.92 to 10.03 ± 3.28 in the UPPP group and from 19.42 ± 6.04 to 13.39 ± 4.36 in the MRFTA group. The mean postoperative AHI in the UPPP group was significantly lower than in the MRFTA group ($P = .02$). Comparison of the success rate (73% versus 40%) revealed that UPPP was more successful than MRFTA. Although subgroup analysis in patients with moderate OSA was also in favor of UPPP (77% versus 30%, $P = .03$) but MRFTA in patients with mild OSA was as successful as UPPP in AHI reduction (70% versus 50%, $P = .36$). Our data demonstrated that UPPP and MRFTA could both significantly improve lowest and mean blood O_2 saturation postoperatively.

We used ESS and SAQLI to evaluate patient-reported outcomes. Previous research demonstrated that the minimum important difference to patients is represented by a change of 0.5 when a 7 item Likert scale such as SAQLI is used.[33,34] Our data showed that UPPP and MRFTA could significantly improve patient's quality of life in all dimensions according to SAQLI.

In a comparison of quality-of-life improvements in daily functioning, emotional functioning and symptoms showed no significant difference between the 2 groups but the MRFTA group showed significant higher improvement in social interaction, treatment-related symptoms, and SAQLI total score than the UPPP group. The reason why the UPPP group scored worse in the treatment-related symptoms subscale postoperatively was a higher rate of complications such as throat pain, soreness in the nose or throat, having fluid/food pass into the nose when swallowing, and voice change.

In this study, the ESS score of patients returned to normal levels following UPPP and MRFTA. No significant perioperative or postoperative complication such as death, bleeding, or respiratory compromise were noted in either group. Difficulty swallowing (including nasal regurgitation) and voice change occurred more often in the UPPP group and caused lower SAQLI total scores in this group. In a study conducted by Kezirian et al., the rate of perioperative and postoperative death was 0.2%.[15] Similar findings were reported by a systematic review of side effects of surgery for OSA.[35] The reported frequencies of difficulty swallowing, voice change, and taste disturbance were 31%, 13%, and 5% respectively, in UPPP operations.

In conclusion, this study suggested that for mild OSA, the efficacy of MRFTA in lowering AHI was comparable to the efficacy of UPPP. MRFTA proved to be more effective than UPPP to enhance quality of life of patients because of less morbidity and fewer treatment-related symptoms. Therefore, MRFTA can be considered as the first surgical treatment option in patients with mild OSA who have velopharyngeal or oropharyngeal lateral wall obstruction.

One limitation of this study worth mentioning is the limited follow-up period. All patients were evaluated 6 months after surgery. Further studies with longer follow-up are required to evaluate long-term safety and efficacy of these procedures. In addition, postoperative evaluation of Friedman tongue position and tonsil size would be helpful to achieve a more comprehensive scope of the treatment.

ABBREVIATIONS

AASM, American Academy of Sleep Medicine
AHI, apnea-hypopnea index

ASA, American Society of Anesthesiologists
BMI, body mass index
DBP, diastolic blood pressure
DISE, drug induced sleep endoscopy
ESS, Epworth Sleepiness Scale
MRFTA, modified radiofrequency tissue ablation
OSA, obstructive sleep apnea
PSG, polysomnography
RFTA, radiofrequency tissue ablation
SBP, systolic blood pressure
SAQLI, Sleep Apnea Quality of Life Index
UPPP, uvulopalatopharyngoplasty

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DISCLOSURE STATEMENT

The authors report no conflicts of interest.